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ABSTRACT

This paper provides an introduction to a particular systems-theoretical approach to problem-solving in the management of education usually referred to as soft-systems methodology (SSM), developed by Peter Checkland in the 1970s. SSM should provide a powerful tool for managers in education at any level who have a strategic role because it can be used to address many problems and questions such as whether current courses meet student needs, or how to introduce a college-wide quality improvement system. The paper begins by providing background information on systems theory and then moves on to discuss the educational context and micropolitics and to describe the methodology of SSM, first through an overview and then through a detailed description of its seven stages. A discussion of the use of SSM in strategic planning and quality assurance concludes the paper. Contains eight references. (GLR)

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Mendip Papers

Soft-systems methodology:
an approach to problem-solving in the management of education

J Kowszun

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Introduction

The aim of this paper is to give an introduction to a particular systems-theoretic approach to problem-solving in management usually referred to as soft-systems methodology (SSM), developed by Peter Checkland in the 1970s. It is my belief that this approach is particularly relevant to education now for several reasons:

- it is a methodology which should appeal directly to those whose working lives are centred on the business of learning since the basis of Checkland's approach is to engage in processes which enable learning about the problem situation to take place;
- the SSM approach is helpful in the context of developing quality assurance as it provides a clear methodology for the '...systematic and thorough exploration of everything the organisation does, the subsequent setting of clear standards and the documentation of these standards on which the service to customers will be based,' (Miller and Innis, 1992);
- SSM enables a deep exploration of critical issues which, in the light of incorporation, is something all of us in the new FE sector are having to do;
- all too often strategic issues involving human resources which interact in many complex ways can seem so large that it is far from clear how to begin an analysis. SSM provides a step-by-step procedure which gives structure to an analysis and enables managers to 'plan the planning'.

SSM should provide a powerful tool for managers in education at any level who have a strategic role. SSM can be used to address many problems and questions, for example, 'is our current Business Studies course meeting the needs of our clientele?' or 'how should we go about introducing a college-wide quality improvement system?'.

Systems: background

The word 'system' has become a familiar part of our daily vocabulary and this reflects the way in which systems thinking has become an important intellectual tool in most disciplines. Consideration of a simple definition of system, such as:

> an assemblage of parts viewed as a single entity which maintains its identity under a range of external conditions,

reveals what a generalised concept this is. This begs the question how can such a very general concept be useful? The answer lies perhaps in the way of looking at the world that it implies. A systems viewpoint is one that seeks to cope with complexity by aggregating objects, functions, activities, etc., into a reasonably small number of intellectually manageable 'chunks' which can then be looked at in relation to each other. To be useful these 'chunks' must have a meaningful identity which can be readily comprehended: if they can be seen to have a function or purpose then they are systems. The concept of 'modularity' in education almost certainly owes its origin to systems thinking.

Systems theory developed originally from science and engineering. Initially it was applied to situations with a high degree of predictability and susceptibility to mathematical analysis. Such systems are usually described as 'hard' systems. This term also covers computer systems and their software; the reader will probably be familiar with the term 'systems analysis' in the context of computers. Situations which involve a high degree of complexity and human involvement with low susceptibility to 'hard' modelling are usually described as 'soft' systems. Since they usually involve people, their interactions and their management they are also called human activity systems (HAS). There have been attempts to import some of the powerful ideas of systems analysis into the theory of soft systems. Notable amongst these is the work of Stafford Beer (1985) who has developed a systems approach to management from ideas in cybernetics using the notion of the viable system model (VSM). Brian Wilson (1984) gives a good overview of other approaches used to model human activity systems – including SSM. Carter *et al* (1984) give a very readable and visually stimulating basic introduction to systems thinking in management.

We are concerned here with the work of Peter Checkland (1981) and his soft systems methodology. SSM represents a radical change in approach from that of trying to make hard systems ideas work in the soft systems context to taking the essential nature of soft systems as a starting point. Checkland's valuable contribution in this field is to change the paradigm from one of constructing and modifying systems in line with criteria of *correctness* and *optimum performance* to one of *learning* about the systems involved in order to gain deep insights into the problem situation.

The educational context and micropolitics

Any educational establishment consists of complex of inter-connected systems. In principle the systems can be fairly easily enumerated: admissions, curriculum management, finance, pastoral, personnel, premises and so on, and their interactions explained. In reality, there are many other systems operating and the systems which should exist in theory are often fragmented and partial in practice. It has been argued, for example by Ball (1987), that educational institutions are particularly prone to the influence of 'micropolitics'. This term tries to encapsulate the bargaining for power that takes place between groups of individuals and their attempts to achieve their diverse political objectives. It is the micropolitical climate of an institution that determines the reality of its day-to-day operations. It is interesting to note that Ball says the following:

> ..organisational theorists have remained locked...within the stultifying parameters of systems theory and have tended to neglect description in favour of prescription... (Ball 1987)

I can only surmise that the systems theory that he had in mind was an impoverished one and I would claim that SSM offers a system-theoretic approach rich enough to help gain insight into the micropolitical issues of an organisational problem. The recognition that we are dealing always with people, who will invariably 'mess up' our neat theories and procedures, is built into the philosophical stand-point of SSM.

Overview of the methodology

Checkland's methodology was developed through his consultancy work which started out dealing with problems that fell squarely into the 'hard' systems area. Gradually the commissions he and his team took on moved into 'softer' areas such as corporate organisational problems, manufacturing performance and service marketing. This led to a real need to develop methods that worked in these areas. It is interesting to note that as the Lancaster University-owned consultancy ISCOL Ltd. in which Checkland worked gained credibility, so it found itself being presented increasingly with unstructured problems of the kind that might be expressed as baldly as 'we feel something is wrong in this situation, could you help?'.

Perhaps the most curious example Checkland gives is the government-sponsored analysis to clarify the intended meaning of the theoretical concept of 'terotechnology' which led to the formulation of an official definition of the concept. As Checkland puts it:

> It was not a case of defining and describing something which existed in the real world. Rather the task was to describe something which, in the opinion of the Department of Trade and Industry and some interested industrialists, ought to be taken seriously by anyone concerned with the process of generating wealth by industrial activity. (Checkland 1981 p202)

SSM has seven stages as follows:

1 the problem situation unstructured;
2 the problem situation expressed;
3 root definitions of relevant systems;
4 conceptual models;
5 comparison of 4 with 2;
6 definition of feasible desirable changes;
7 action to solve the problem or improve the situation.

Although the methodology is usually described in terms of these seven stages it is not intended or desirable that a particular analysis should proceed sequentially through the stages. Checkland's own research suggests that

> ...the most effective users of the methodology have been able to use it as a framework into which to place purposeful activity during a systems study, rather than as a cookery book recipe. (Checkland 1981 p163)

The methodology in more detail

Stages 1 and 2: finding out

These are the exploratory stages for which Checkland uses the term 'expression'. The work during these stages consists of gathering information in order to build up as rich a picture of the situation as possible. The first stage is very much about a kind of brain-storming: taking in everything that may be relevant with limited evaluation. The second stage seeks to bring this information into some sort of diagrammatic and written order (the 'rich picture'). It is important that the rich picture tries to be a neutral presentation of the structures, processes and relationships between them as observed in the situation (through the researchers' eyes and through the eyes of others). It is important to avoid at this stage is any early attempts at formulating system definitions which may then lead to a prejudging of the issue in the later stages.

For example, a school or college may be looking at the problem of what sort of approaches to quality improvement they should adopt. The initial information gathering phase could consist of the following elements:

- gather together brief summaries of statutory instruments which have a bearing on quality (Orders under the Further and Higher Education Act 1992);
- do the same for any other bodies which have authority in the situation (local education authority, examining groups, validating bodies, British Standards Institute, International Standards Office);
- review the current literature;
- interview members of the senior management team to elicit their views of the meaning of 'quality' in the educational setting;
- do the same for other staff, governors, parents and students;
- gather examples of good practice from elsewhere in education and from other sectors (BS 5750, ISO 9000, total quality management, strategic quality management, quality circles, etc.).

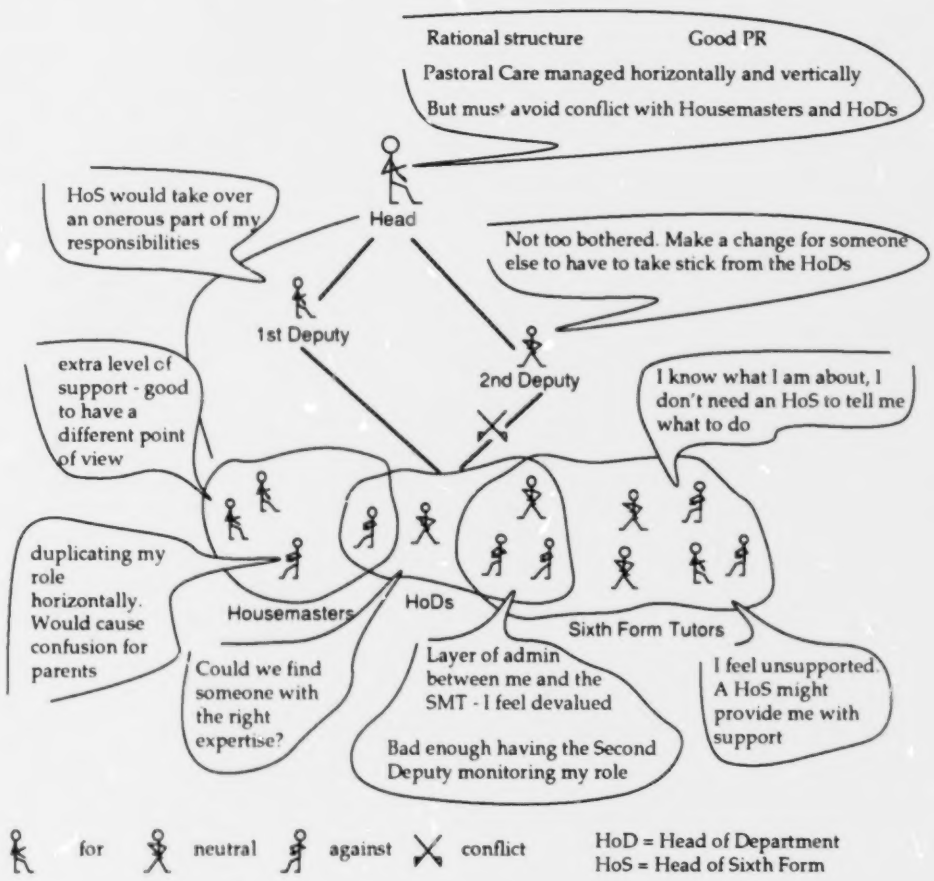
This mass of information now needs to be somehow represented on a single complex diagram so that it can be scanned, at least superficially, all in one place.

Figure 1 shows the beginnings of a rich picture associated with the problem of the possible introduction of a head of sixth form in an 11-18 school organised into houses. It shows the results of interviews with some of the key figures in the situation. Later work might include interviews with governors, parents and sixth-formers.

Preparing a rich picture is a creative activity which seeks to set down that which has been learned coherently and dynamically. It should not be an attempt to start modelling the situation.

Once the rich picture is complete it can be used to infer descriptions of systems which are relevant to the situation.

Figure 1: Simple rich picture


Rational structure
Good PR
Pastoral Care managed horizontally and vertically
But must avoid conflict with Housemasters and HoDs
Head
HoS would take over an onerous part of my responsibilities
Not too bothered. Make a change for someone else to have to take stick from the HoDs
1st Deputy
2nd Deputy
extra level of support - good to have a different point of view
I know what I am about, I don't need an HoS to tell me what to do
duplicating my role horizontally. Would cause confusion for parents
Housemasters
HoDs
Sixth Form Tutors
Could we find someone with the right expertise?
Layer of admin between me and the SMT - I feel devalued
I feel unsupported. A HoS might provide me with support
Bad enough having the Second Deputy monitoring my role
for
neutral
against
conflict
HoD = Head of Department
HoS = Head of Sixth Form

Stage 3: root definitions

The objective of stage three is to set down carefully-worded root definitions of systems deemed relevant to the situation. These definitions are crucial in determining the kind of modelling that can take place and may often need to be re-assessed in the light of outcomes of other stages of the SSM.

At the heart of a root definition of a system will be some kind of *transformation* process (T). In the root definition there will be a verb (or verbs) together with its direct object(s) which make the nature of the transformation(s) explicit. Pursuing the example of quality improvement, an imaginary researcher might formulate a definition of one of the relevant systems to be:

> a system to apportion blame when things go wrong. (Example 1)

(Hopefully this definition would be quickly rejected in favour of others – although it could be a valid reflection of the realities of the situation!) The main verb here is *apportion* and the transformation implied takes the that which has gone wrong as input and outputs the name of one or more individuals to blame.

To take a different example, an educational institution may be looking at its pastoral provision. A first attempt at a root definition of one of the relevant systems might be:

> a system to put students with welfare problems in touch with an appropriate agency. (Example 2)

As a root definition this statement is too vague, as will be seen below. However, it clearly identifies a transformation that takes welfare problems presented by students and outputs appropriate referrals.

A root definition will usually define *customers* (C) of the system. These will be the victims or beneficiaries of the system and will typically appear as the indirect objects of the main verbs used in the definition. So, in example 1 above the customers are those who will be blamed and only figure in the definition by implication. In example 2 the customers appear to be the appropriate agencies, not the students who present with their welfare problems. Perhaps a better-worded definition might be:

> a system for giving referrals to students who present their welfare problems to members of the pastoral team. Such referrals are made to appropriate outside agencies. (Example 3)

In a human activity system there will be *actors* (A) who are instrumental in carrying out the transformation(s) of the system. In example 3 the wording makes clear that members of the pastoral team will be the actors in this system. Note that the outside agencies are not actors in this system, they are part of the output.

To understand power relationships inherent in one or more interacting systems it is important to establish who or what *owns* (O) the system under consideration. Ownership is perhaps ultimately determined by asking 'who has concern for this system with the authority to shut it down?'. Taking example 3 again, here there is no clear indication of ownership. It could be argued that in a good implementation of this system the pastoral team will feel 'ownership' of the system but this is not the sense in which ownership is intended in SSM. Ultimately, then, it will be the pastoral management of the institution who determine whether such referrals continue to be made officially; so a re-wording of example 3 to make ownership explicit might be:

> a system under the control of the pastoral manager for giving appropriate referrals to outside agencies to students who present their welfare problems to members of the pastoral team. (Example 4)

Any system has to operate within a particular *environment* (E) and this will place constraints upon its activities which are not under the system's control. For example, the issue under consideration might be the delivery of study skills within an educational institution and one of the relevant systems considered might be based on a peer-tutoring approach. Here is a possible root-definition for such a system:

> A pastoral management-owned system to provide study skills support to students using volunteers from the student body with the quality of their support activities monitored by teaching staff. (Example 5)

Notice that the environment in which such a system would operate must use volunteer students only (no funds), and must be monitored by teaching staff (to ensure quality).

These five considerations (T, C, A, O, E) were found by Smyth (1976) to provide adequate criteria for testing whether a root-definition is well-formulated. To these was added a sixth criterion usually referred to as *Weltanschauung* (W) or *world view*. This refers to the outlook or basic assumptions on which the activity in question is based. It may be something which has not been questioned but needs to be explored if the root definition is to have meaning. In example 1 above there is presumably an underlying assumption that when things go wrong the guilty must be punished. In example 5 there is an underlying view that supporting students in their educational endeavours is a natural and desirable thing to do. It may well be that in a particular analysis more than one world view may be identified and a separate root definition may need to be made corresponding to each world view. So alongside example 1 there might be a further root-definition:

> a senior management team-owned system to enable middle-mangers to identify the causes of breakdown when things go wrong and recommend corrective actions to the senior management team. (Example 6)

Here the underlying world view is that things which go wrong need to be fixed. This system is different from that in example 1 in that its customers are the senior management team and its outputs are recommendations for corrective action.

The six criteria discussed above are referred to collectively by the mnemonic CATWOE. The formulation of a root definition is a difficult semantic exercise which needs to be shared by concerned parties and informed by some vigorous argument!

Stage 4: making models

This can be the hardest part of the process in that it involves making an abstract model of the system as implied *by the root definition* and is not an attempt to model reality as it is or should be. The model is a conceptual one and, usually, takes the form of an appropriate diagram. One way of tackling the modelling is to start by listing the activities implied by the root definition. Take example 4 again:

> A pastoral management-owned system to provide study skills support to students using volunteers from the student body with the quality of their support activities monitored by teaching staff.

The implied activities here could be:

- identify peer tutors;
- determine the tutoring strengths of peer tutors;
- advertise the service;
- receive tutees who present themselves;
- identify the needs of tutees who present themselves;
- arrange times and rooms for tutoring to take place;
- monitor the performance of peer tutors.

Each of these activities represent a mini-root definition and, as such, define sub-systems of the system being modelled. A conceptual model of this system could then consist of the subsystems and the relationships between them together with the various inputs, outputs and flows (see **Figure 2**).

To be sure that each sub-system is well-defined a separate CATWOE analysis could be done on each one and, if necessary, each sub-system could then be modelled conceptually. The process of modelling subsystems of systems could be continued until the component sub-systems become simple agents which are not susceptible to further useful analysis.

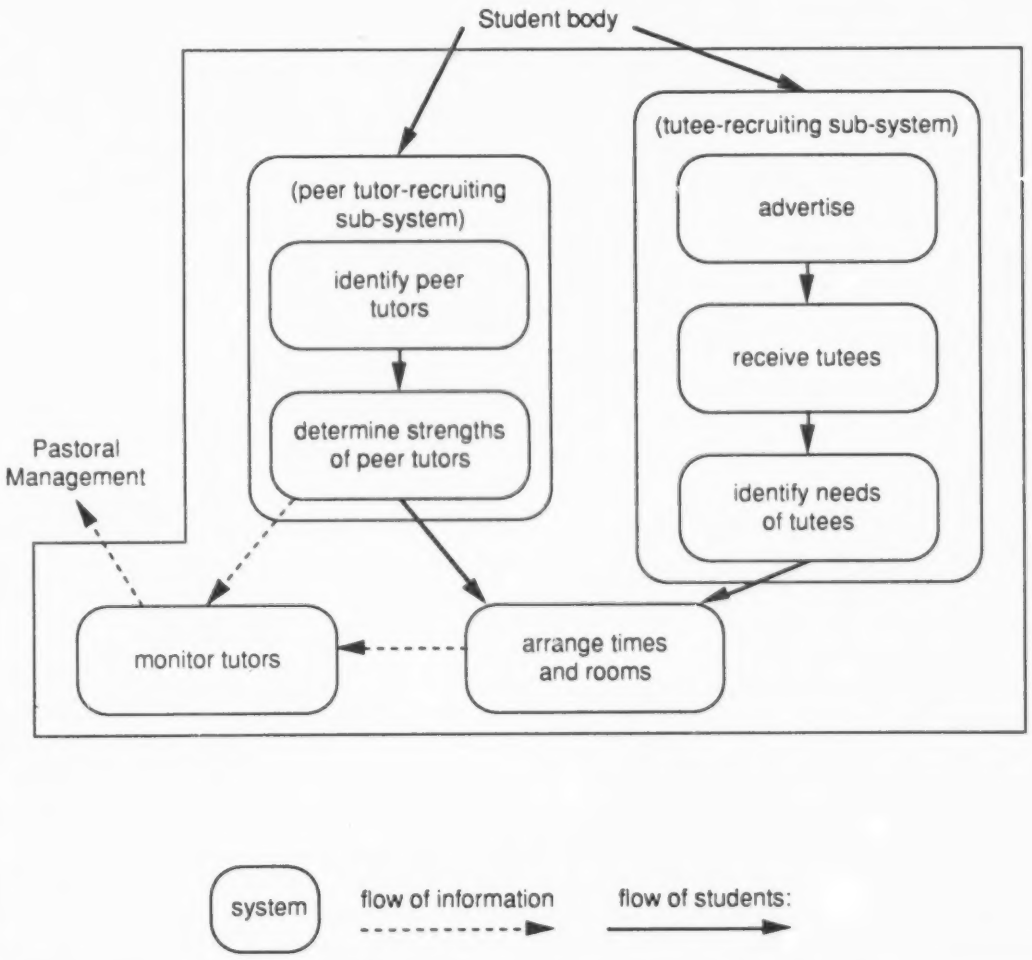
The conceptual models developed from root definitions need to be the focus of informed discussion. Checkland provides a set of criteria for testing a conceptual model based on his experiences, in practical situations, of those factors whose absence or inefficiency have turned out to crucially affect the analysis:

- the system has a clear purpose or mission;
- measure of performance: are there explicit criteria for what would constitute 'good' and 'bad' performance?
- there is a decision-taking process within the system;
- the system has components which are themselves well-defined systems;
- the components of the system interact so that effects and actions can be transmitted through the system;
- the system exists as part of a wider system or environment with which it interacts;

- sharpness of the system boundary: is it clear what is part of the system and what is not?
- the system has physical and/or abstract resources at the disposal of the decision-taking process;
- the system has some kind of stability in principle and is not ephemeral.

For the example in **Figure 2** the consideration of measure of performance requires some careful thought about the monitoring sub-system.

Figure 2: model of a root-definition



Stage 5: comparison

This is the stage that takes us back to the real world and the original problem situation. The comparing of reality with the conceptual model(s) is a creative process which will largely depend on each different situation. Checkland (1981) identifies several broad approaches which have been found to work in certain situations.

One approach is to engage in a dialogue in which general features of the problem situation are questioned in the light of the conceptual model. The objective is to arrive at a short-list of significant differences between the model and the real situation. This relatively gentle approach can be structured into a systematic and ordered questioning about every feature of the conceptual model and its realisations in the problem situation (or lack thereof).

This approach might be used with the governors of a school or college who have been looking at their institutional aims. The 'college mission' could be treated as essentially one or more root definitions for the total system or systems which the college embodies. The questioning process might elicit the differences between the *intentions* behind various clauses of the mission statement and their institutional *implications*.

An alternative approach, if the situation warrants it, might be to make a careful reconstruction of past events which led up to the present situation and relate these to the conceptual model. This could easily turn into an attempt to apportion blame so it is important to emphasise the intentions of the process: to understand the micropolitical influences which led to the current situation.

For example, a college redesigns its approach to student services and things go badly wrong. By the time stage 4 is reached it becomes obvious that there is a serious mismatch between what the services should be and what they actually are. However, the organisation and paperwork is very much in line with the conceptual model, so why are things going wrong 'on the ground'? The historical reconstruction seeks to reveal where along the line, for example, energies became diverted into low-priority activities.

A very different method of making the comparison is to go back to stage 2 and to construct a conceptual model of the situation as expressed in the 'rich picture' trying as far as possible to make the form of that model correspond to the conceptual model constructed at stage 4. This allows for a very sharp comparison of reality with the model. It also allows for an interesting reverse approach which takes the conceptual model of reality and asks what root definitions might be implied by this model. It could well be used in the context of the student services example above.

Another simple example is furnished by an exercise I undertook in a previous post. Looking at the termly sixth form reports, I developed a root definition of the reporting system and compared it with the implied definition extracted from reality after looking at many reports and intense discussion with colleagues. One significant difference that emerged was that the implied real system mainly classified students into 'visible' and 'invisible' categories based on perceived classroom participation whereas the corresponding theoretical classification was supposed to be somewhat richer and based on documentary evidence.

This stage of the methodology can lead, quite naturally, into a re-thinking of selection of appropriate systems, root definitions and conceptual models. This kind of dynamic iteration round stages 2, 3 and 4 ensures a deep and thorough discussion of the underlying issues.

Stages 6 and 7: taking action

The comparison stage should lead naturally into a discussion of 'things as they are' and 'things as they might be'. This should generate a list of possible changes that could be made in order to improve the current situation. The process by which one arrives at this stage should have enabled some real learning about the situation to take place so that it becomes possible to make judgements about which changes are likely to be most effective.

However, because we are dealing with human activities, the business of making desirable changes is not likely to be just a matter of listing changes and implementing them. Even with a strong consensus on appropriate action there is the question of feasibility. If, for example, a particular study reveals that a change in values held by a group of individuals is needed – as might be the case in a quality improvement study – then the question of feasibility becomes paramount. Indeed, it may well be the case that this change is not attempted, but other – organisational – changes are made or new systems introduced with the medium-term goal of a shift in values resulting from growing familiarity with new practices.

What happens at this stage will be largely determined by the culture of the institution. If you are lucky enough to work in an innovative culture then the use of SSM would have been explicit and many people in the organisation would have contributed to the various stages of the methodology. Otherwise it is a matter of exercising such skills in the management of change as are available in the situation. I suspect that in an innovative culture it should be possible to install SSM as a standard language of discourse for problem solving and strategic planning.

SSM and strategic planning

In developing potential future marketing strategies for my college I found SSM a very helpful tool. The finding out stages (1 and 2) took the form of a SWOT (strengths, weaknesses, opportunities, threats) analysis developed by the whole staff and amplified in cross-curricular small-group discussions over a period of several weeks. This was part of the senior management team's general approach to evaluating our position at that time but also provided valuable input into the SSM. Additional information included student views, some parental interviews, discussions with teachers from local 11-16 schools and the background papers to the college's current mission statement. From this I constructed a rich picture and listed several relevant systems that expressed the 'desirable transformations' that the college effected or might effect for its clients. From these I generated various root definitions. Because we operate in a competitive environment I hope the reader will forgive me for not sharing further details of my work!

The SSM as such was very much an activity I carried out on my own, although I engaged in various discussions and arguments in what, to me, were parts of the methodology but to others were discussions of the kind I would be expected to have anyway. The point here is that it would not appear to be necessary to make SSM explicit if one has ownership of a problem – although I feel it is always desirable to be open about the kind of tools of analysis one is using.

SSM has much to offer the process of institutional review: defining or re-defining the corporate mission and setting the medium-term strategic plan. In this context a suitably expanded form of the corporate mission becomes a set of root definitions of the systems which the institution embodies. The really significant contribution of SSM lies in the making of conceptual models and comparing them with reality. It is a very sharp way of asking 'can (or does) this happen on the ground?'.

The comparison technique of attempting to fit root definitions to the systems that appear to be operating in reality should give some valuable insight into the micropolitical climate in an institution. As I have mentioned earlier, it is this climate which will determine what can actually be made to work and therefore understanding it should provide guidance in setting achievable targets. It may also indicate areas where it could be worth making a serious attempt to alter the balance of micropolitical power in order to enable change in a desirable direction.

SSM and quality assurance

The current literature on quality assurance aimed at education favours either strategic quality management (SQM) as in, for example, Consultants at Work (1992) or some variant of total quality management (TQM) as in, for example, The Open College (1990). The TQM approach tends to be geared particularly towards BS 5750. Either approach is essentially system-theoretic and lends itself very naturally to SSM.

In SQM the systems problem can be related directly to the corporate mission and is concerned with working through the key systems and their measures of performance across the various phases and levels of the institution's operation. Having performed an initial SSM analysis of the quality problem, the iteration between stages 2, 3, 4 and 5 can become part of the on-going quality assurance process as it involves comparing ideals of relevant systems with the reality of their operation and adjusting accordingly. It should be relatively easy to adapt the discussion of the use of SQM in an educational setting given in, for example, Miller and Innis (1992) to an approach based on SSM.

With TQM the cycle through stages 2, 3, 4 and 5 of SSM can be adapted directly to the problem of procedure-writing. So, to take a simple example, writing a procedure for dealing with prospective students' application forms can be taken through the following stages:

- description of what actually happens now (e.g. date-stamped, passed to admissions officer who selects an interviewer in the appropriate division, etc.);

- a discussion of what it's all for (arrange an interview with the 'right' person, say);
- a root definition of the system which deals with application forms;
- construction of a conceptual model, most likely in the form of a flow-chart;
- comparison with the original description;
- suggested modifications to the existing procedure;
- write or re-write the procedure.

These are, of course, the seven stages of SSM which adapt naturally to this application.

Conclusion

In this paper I have tried to indicate the power of SSM as a framework for tackling a range of problems in the management of education. I have concentrated my examples on issues of quality and strategic planning. However, I believe that there is a wider applicability of SSM in education particularly, with suitable adaptations, as a sophisticated package of study, information and problem-solving skills for students faced with large-scale project work. This is an area for development which I find very exciting, but I have only just begun to explore the possibilities.

I would like to conclude this discussion with an invitation to anyone who has used systems thinking in the context of educational management to contact me and tell me about their experiences. Perhaps this might be a good time to set up a 'Systems in Education' group in the FE sector?

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The list of Mendip Papers is growing steadily. If you have a particular piece of research in further, higher or adult education, or have undertaken an innovative management initiative which would be of interest to other managers, please contact the series editor, Lynton Gray at The Staff College with a view to publishing your work and disseminating it throughout the post-school education system.

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